Journal of the Lepidopterists' Society
51(2), 1997, 139–148

LARVAL HOSTS OF *URESIPHITA* HÜBNER (CRAMBIDAE)

ROSEMARY LEEN
United States Department of Agriculture, Forest Service,
Pacific Southwest Research Station, P. O. Box 236, Volcano, Hawaii 96785, USA

ABSTRACT. A survey of the literature and museum collections of *Uresiphita* indicates larval hosts are primarily quinolizidine-bearing plants in tribes of the Fabaceae. Three species, *Uresiphita reversalis*, *U. ornithopteralis* and *U. polygonalis*, were collected from seven genera in the Genisteae (*Chamaecytisus*, *Genista*, *Lupinus*, *Spartium*, *Laburnum*, *Ulex* and *Cytisus*) and from three genera in the Sophoreae (*Sophora*, *Pericopsis* and *Bolusanthus*). Two species, *U. reversalis* and *U. polygonalis*, were collected from three genera in the Thermopsidae (*Baptisia*, *Anagyris* and *Piptanthus*) and two, *U. reversalis* and *U. ornithopteralis*, were collected from two genera in the Bossiaceeae (*Hovea* and *Templetonia*). A few legume species that are not known to bear quinolizidine alkaloids were also reported. In particular, *U. reversalis*, *U. polygonalis*, and *U. ornithopteralis* were each collected from *Acacia* (Mimosaceae) in areas as widely distributed as Australia and the United States (California, Texas and Hawaii). This is a consistent anomaly in the overall host-use pattern. Other nonleguminous species have been reported but are probably not indicative of hosts upon which development may be completed.

Additional key words: Pyralidae, Pyraustinae, aposematism, host plant range, French broom, quinolizidine alkaloids.

In 1983, *Uresiphita reversalis* (Guenée) caused significant damage to *Genista monspessulana* (L.) L. Johnson, also known as French broom, in the San Francisco Bay Area. Thus, *U. reversalis* was thought to be useful as a control agent against the introduced weedy brooms in California (Leen 1992, 1995). Little was known about the biology and host plant range of the genus *Uresiphita* Hübner so this survey of collections and publications was begun to ascertain if a pattern of host use could be detected.

Although the genus is in need of taxonomic revision, several species and subspecies are recognized and accepted as follows. *Uresiphita reversalis*, the Genista caterpillar, is the only species known to occur in North America (Munroe 1976). *Uresiphita ornithopteralis* Guenée, the tree-lucerne moth, is an Australian species (Common 1990). Several subspecies are recognized within *Uresiphita polygonalis* ([Denis and Schiffermüller]) by Clarke (1971). *Uresiphita polygonalis maorialis* (Felder & Rogenhofer), the kowhai moth, is indigenous to New Zealand; *Uresiphita polygonalis virescens* (Butler) is considered indigenous to Hawaii but may be introduced (Zimmerman 1958); and *Uresiphita polygonalis ochrocrossa* Clarke is indigenous to Rapa Island (Clarke 1971). Palm (1986) lists *Uresiphita limbalis* as a synonym of *U. polygonalis*. This paper presents a collation of information available on geographical distribution and hosts of these three species of *Uresiphita*.

MATERIALS AND METHODS

Information on the distribution and collections of *Uresiphita* was obtained from publications and museum collections. A list of these sources appears in Tables 1 and 2. The primary source of information on the dis-

TABLE 1. Published records and collections of leguminous host plants of *Uresiphita* spp. Sources: 1, Anonymous 1935; 2, Arnett 1985; 3, Calif. Acad. Sci., USA; 4, Calif. Dept. Food and Agric., USA; 5, Common 1990; 6, Crosswhite 1985; 7, Fenemore 1982; 8, Forbes 1923; 9, Froggatt 1907; 10, Gaskin 1966; 11, Gibbs 1976; 12, Hanneman 1964; 13, Hudson 1928; 14, Khotko and Molchanova 1974; 15, Kimball 1965; 16, Leonard 1926; 17, Los Angeles Co. Mus., USA; 18, Mastro 1990; 19, McKenzie 1933; 20, Meyrick 1889; 21, Miller 1935; 22, Mulvay 1978; 23, Munroe 1976; 24, Natl. Mus. Nat. Hist., Smithsonian Inst., USA; 25, Natural Hist. Mus., UK; 26, Perez de Paz et al. 1986; 27, personal collection; 28, Pinhey 1975; 29, Purdie 1882; 30, Scott 1984; 31, Smith 1890; 32, Swezey 1954; 33, Univ. Calif. Berkeley, USA; 34, Univ. Calif. Riverside, USA; 35, Univ. Missouri Columbia, USA; 36, Zimmerman 1958; 37, probably *Prosopis pallida* (Humb. & Bonpl. ex Willd.) Kunth.

Hostplant	*U. reversalis*	*U. polygonalis* (excl. *maioralis*)	*U. polygonalis maioralis*	*U. ornithopteralis*
CAESALPINIACEAE				
Cassiaceae				
Cassia L.	Florida[15]			
Cassia alata L.	California[4]			
FABACEAE				
Bossiaceae				
Hovea R.Br ex W.T.Ait.				Australia[5]
Templetonia R.Br. ex W.T.Ait.				Australia[5,9]
Templetonia retusa (Vent.) R.Br.	California[4]			
Carmichaeliae				
Carmichaelia R.Br.			New Zealand[13]	
Genisteae				
Chamaecytisus proliferus (L.) Link				Australia[5,9]
Cytisus Desf.	California[3,4]	Germany[12]		
	USA[24]	Norfolk Island[25]		
		South Africa[28]		
Cytisus scoparius (L.) Link	California[33]		New Zealand[13]	
Cytisus supranubius (L.) Kuntze	California[3,4,17]			
	USA[24]			
Genista L.	California[3,4,5,6,18,24,33]	Germany[12]		Australia[5]
	Arizona[6]	USSR[14]		
	USA[23]			
Genista linifolia L.	California[18]			

TABLE 1. (continued)

Hostplant	*U. reversalis*	*U. polygonalis (excl. maioralis)*	*U. polygonalis maioralis*	*U. ornithopteralis*
Genista monspessulana (L.) L. Johnson	California[4,19]			
	USA[24]			
Genista stenopetala Webb & Berth.	California[4]	Canary Islands[25,26]		
Laburnum Fabr.	California[4]			
	Kansas[6]			
	Nebraska[6]			
	Maryland[6]			
	USA[24]			
Laburnum alpinum (Mill.)	California[33]			
	USA[24]			
Laburnum x *watereri* "Vossii" (Kirchn.) Dipp.	USA[24]			
Lupinus L.	Florida[15]	South Africa[28]	New Zealand[7,10,21,30,31]	Australia[5]
	California[4,33,34]			
	New York[6]			
	Texas[6]			
	USA[23,24,35]			
Lupinus arboreus Sims	California[27]		New Zealand[1,22]	
Lupinus diffusus Nutt.	Florida[15,27]			
Spartium junceum L.	California[3]	South Africa[28]		Australia[5]
	Georgia[6]			
	USA[23,24]			
Ulex L.		Germany[12]		
Ulex europaeus L.		Madeira[25]		
Phaseoleae				
Phaseolus L.		Germany[12]		
Sophoreae				
Bolusanthus Harms		South Africa[28]		
Pericopsis Thwaites		South Africa[28]		
Sophora L.	USA[24]	Hawaii[32]	New Zealand[7,11,20]	
Sophora arizonica S. Wats.	Arizona[6]			
Sophora chrysophylla (Salisb.) Seem.		Hawaii[36]		

TABLE 1. (continued)

Hostplant	*U. reversalis*	*U. polygonalis* (excl. *maioralis*)	*U. polygonalis maioralis*	*U. ornithopteralis*
Sophora microphylla Ait.				Australia[5]
Sophora secundiflora (Ort.) Lag. ex DC	Arizona[6,23,24]			
	Texas[6]			
	USA[23,24]			
Sophora tetraptera J.F.Mill.			New Zealand[10,29]	
Sophora tomentosa L.	Florida[15]	Northwest India[25]		
	USA[23]			
Thermopsidae				
Anagyris foetida L.		Spain[25]		
Baptisia Vent.	New York[8,16]			
	USA[2,24]			
Baptisia tinctoria (L.) R.Br.	Florida[15]			
	USA[23,24]			
Piptanthus Sweet		England?[25]		
Piptanthus nepalensis (Hook.) D.Don ex Sweet	California[3]			
Trifolieae				
Trifolium L.			New Zealand[10,13]	
Trifolium repens L.			New Zealand[13]	
MIMOSACEAE				
Acacieae				
Acacia Mill.	California[4]			Australia[5]
	Texas[6]			
	USA[24]			
Acacia koa A. Gray		Hawaii[36]		
Adenthereae				
honey locust[37]	California[4]			
Ingeae				
Cedrela P.Br.		South Africa[28]		

tribution of species other than *U. reversalis* was the Natural History Museum, London, U.K. Very few host records were associated with those specimens, so the majority of host information for all *Uresiphita* species was obtained from the literature and correspondence or visits to museums and collections within the United States. Plant species' names are reported as they are currently accepted rather than exactly as reported on the records. Scientific names, in lieu of common names, are reported if no other species or genus could be accorded the common names of the associated collection record.

RESULTS

Distribution. The genus *Uresiphita* has been collected from all major continents occurring between 50° north and 50° south latitude. Collection sites in the northern hemisphere extend into parts of Canada (Nova Scotia), the southern part of the United Kingdom and into parts of Germany, Poland and the former USSR. Collection sites in the southern hemisphere extend to New Zealand, South Africa, and the Amazonian region of Brazil. Collections have also been made from parts of western China and several island locations, including Fiji, Norfolk Island, Rapa Island, the Hawaiian Islands, Madeira, the Canary Islands, the Bahamas and San Domingo. Munroe (1976) reported that *Uresiphita* is found in the Marquesas, although Clarke (1986) made no mention of this genus in his volume on the Pyralidae and Microlepidoptera of the Marquesas Archipelago. Munroe (pers. comm.) states this was an error on his part.

Hostplant relationships. Publications and collections of *Uresiphita* indicate all use leguminous species from tribes that are known to contain quinolizidine alkaloids (Table 1). These tribes are all within the Fabaceae and include the Genisteae, Thermopsidae, Sophoreae and Bossiaceeae. Three species, *U. reversalis*, *U. ornithopteralis*, and *U. polygonalis*, were recorded from seven genera in the Genisteae (*Chamaecytisus*, *Genista*, *Lupinus*, *Spartium*, *Laburnum*, *Ulex* and *Cytisus*) and from three genera in the Sophoreae (*Sophora*, *Pericopsis* and *Bolusanthus*). Two species, *U. reversalis* and *U. polygonalis*, were recorded from three genera in the Thermopsidae (*Baptisia*, *Anagyris* and *Piptanthus*) and two, *U. reversalis* and *U. ornithopteralis*, were recorded from two genera in the Bossiaceeae (*Hovea* and *Templetonia*). Other reported host tribes within the Fabaceae include the Phaseoleae (*Phaseolus*), Trifolieae (*Trifolium*) and the Carmichaeliae (*Carmichaelia*) (Table 1). The latter fabaceous tribes are not known to contain quinolizidine alkaloids.

Native host plants of *U. reversalis* include *Lupinus*, *Baptisia* and *Sophora* and introduced hosts include *Genista* and *Spartium* (Table 1). *Cytisus scoparius* (L.) Link is an introduced plant that is also reported

TABLE 2. Published records and collections of non leguminous host plants of *Uresiphita* spp. Sources: 1, Arnett 1985; 2, Calif. Dept. Food and Agric., USA; 3, Forbes 1923; 4, Froggatt 1907; 5, Gaskin 1966; 6, Leonard 1926; 7, Mulvay 1978; 8, Munroe 1976; 9, Natl. Mus. Nat. Hist., Smithsonian Inst., USA; 10, Pinhey 1975; 11, San Diego Nat. Hist. Mus., USA; 12, Smith 1890; 13, Texas A & M Univ., USA; 14, may be *Kalmia* L. in the Ericaceae, *Umbellularia* (Nees) Nutt. in the Lauraceae, or *Myrica* L. in the Myricaceae.

Hostplant	*U. reversalis*	*U. polygonalis (excl. maioralis)*	*U. polygonalis maioralis*	*U. ornithopteralis*
Asteraceae				
Chrysanthemum L.			New Zealand[5,7]	
Boraginaceae				
Ehretia anacua (Teran & Berl.) I.M. Johnston	Texas[13]			
Buddleiaceae				
Buddleja L.	California[2]			
Celastraceae				
Putterlickia Endl.		South Africa[10]		
Caprifoliaceae				
Lonicera L.	USA[1]			
Lonicera sempervirens L.	New York[3,8]			
	USA[1]			
Viburnum L.	California[2]			
Geraniaceae				
Pelargonium L' Her.	California[2]			
Liliaceae				
Asparagus L.	California[2]			
Myrtaceae				
Myrcia tomentosa (Aubl.) DC	USA[9]			
Oleaceae				
Olea europaea L.	California[2]			
Forsythia Vahl	California[2]			
Rhamnaceae				
Discaria toumatou Raoul			New Zealand[12]	
Rosaceae				
Adenostoma fasciculatum Hook. & Arn.	California[11]			
Rosa L.	California[2]			
Rutaceae				
Citrus L.	California[2]			
Salicaceae				
Salix L.				Australia[4]
Ulmaceae				
Ulmus L.	California[2]			
family undeterminable[14]	California[2]			

as a host of *U. reversalis* but these are not credible records (Leen 1992, 1997). Reported hosts of *U. reversalis* show a consistent geographic pattern in the USA. *Lupinus* spp. are the most widespread native hosts; *Baptisia* spp. are hosts in the east, central and south, and *Sophora* spp. are hosts along parts of the south, especially desert areas such as Texas and Arizona. In the west, *Lupinus* is the only reported native host genus with the earliest record dating from 1930 in Riverside, California. Introduced plants in the genera *Genista*, *Spartium*, *Cytisus*, *Laburnum*, *Piptanthus* and *Templetonia* are reported as hosts throughout the USA. These introduced plants are particularly abundant along the western regions and thus are more frequently reported as hosts of *U. reversalis* than are the relatively less abundant, perennial species of *Lupinus*.

The other two families of legumes, Mimosaceae and Caesalpinaceae, are reportedly used by one or more species of *Uresiphita* (Table 1). *Uresiphita reversalis* was collected from *Cassia* spp. in the Caesalpinaceae (Cassieae) in both California and Florida. Collections of *U. reversalis* from the Mimosaceae are in three tribes: the Ingeae, the Adenthereae, and the Acacieae. Species of *Acacia* (Acacieae) are reported as hosts of *U. reversalis*, *U. polygonalis* and *U. ornithopteralis*. Collections of *U. reversalis* are from *Acacia* in both California and Texas. *Uresiphita polygonalis* were collected from *Acacia koa* A. Gray in Hawaii, and *U. ornithopteralis* were collected from an *Acacia* sp. in Australia.

Other records include nonleguminous families (Table 2). *Uresiphita polygonalis* was reported from *Putterlickia* in the South African family Celastraceae. *Uresiphita polygonalis maorialis* was collected from *Discaria* (Rhamnaceae) and *Chrysanthemum* (Asteraceae) in New Zealand. And *U. ornithopteralis* caused heavy damage to willows (*Salix*) in Australia. Collections and publications of *U. reversalis* were from 10 to 11 nonleguminous families, including the Boraginaceae, Buddleiaceae, Caprifoliaceae, Geraniaceae, Liliaceae, Myrtaceae, Oleaceae, Rosaceae, Rutaceae, Ulmaceae and either the Lauraceae, Myricaceae, or Ericaceae. Two or three species are from plants in each of the Caprifoliaceae, Oleaceae and Rosaceae. All other families were reported on only one occasion. Powell (1992) reported two additional families (Taxaceae and Rubiaceae) as possible hosts that I have not included in my collation for the following reasons. Both records are from the California Department of Food and Agriculture collections. Only pupae were collected from *Taxus* (Taxaceae) and the record or specimen of the collection from *Gardenia* (Rubiaceae) could not be located. Data from Powell's paper were not tabulated since they duplicate information presented here and include some questionable data from Bernays and Montllor (1989). Host specificity tests on *U. reversalis* are presented in Leen (1997) and clarify this matter.

Uresiphita reversalis was collected in California on three separate occasions from barbecue covers originating in Connecticut, Vermont and Massachusetts (California Department of Food and Agriculture Records). The three collections from barbecue covers exceed the number of times larvae were collected from most nonleguminous plants and, obviously, barbecue covers are a 'host' upon which development is not completed.

DISCUSSION

In general, the larval host plants of the genus *Uresiphita* are confined to the quinolizidine-bearing tribes of the Fabaceae. This suggests quinolizidine alkaloids are important to the determination of the host range of *Uresiphita*. The sequestering of quinolizidine alkaloids from *G. monspessulana* by *U. reversalis* was confirmed by Bernays and Montllor (1989) and Montllor et al. (1990). Other *Uresiphita* species also may be found to sequester quinolizidine alkaloids since the aposematic coloration, gregarious habits and host plant range are similar among *Uresiphita* larvae (Leen 1992, 1995). One genus, *Cytisus*, bears quinolizidine alkaloids but is not suitable for development of both *U. reversalis* and *U. polygonalis* (Leen 1992, 1997). Confusion in nomenclature has surely led to erroneous reports on *Cytisus* and thus all reports remain to be substantiated (Leen 1992, 1997). Collections from other genera in tribes of the Fabaceae and from the Caesalpiniaceae are questionable because members of these tribes were rejected by *Uresiphita* and collections are rare. However, the collections of three species of *Uresiphita* from *Acacia* spp. in different localities suggest this may be an accurate report. This is an anomalous host plant since *Acacia* is not known to bear quinolizidine alkaloids although *Acacia* has been reported to contain other types of alkaloids (White 1954, 1957).

Although some nonleguminous plant families are known to contain genera that bear quinolizidine alkaloids (Schwarting 1973, Wink 1992), none of the tested genera in these particular families and others were acceptable (Leen 1997). Just as the collections from barbecue covers are not indicative of host use, most of these collection records are probably not indicative of species used by *Uresiphita*. A few other important facts help to discredit these collections as true hosts. Mulvay (1978) noted the collection of *U. p. maorialis* from *Chrysanthemum* occurred because larvae had migrated from their original host, *Lupinus*. *Lonicera sempervirens*, honeysuckle, is frequently cited as a host plant of *U. reversalis*. *Hedysarum coronarium* L. is known as French honeysuckle. French honeysuckle may have been a collection host, and the common names may have led to confusion. However, both species were rejected in the lab and are probably not acceptable hosts under field conditions.

Species in the Genisteae, Sophoreae, Thermopsidae and Bossiaceeae

are undoubtedly hosts of *Uresiphita* spp. Further research in regard to genera such as *Acacia* may refute the present conclusions.

ACKNOWLEDGMENTS

I thank E. Munroe, K. Hagen and M. Dougherty for reviewing the manuscript and J. Santiago-Blay, M. Schaffer, J. Dugdale, J. Brown, and T. Eichlin and for providing information on some of the insect species. I thank P. Kleintjes, S. Tait, B. Des Rochers, J. Hamai and J. Andrews for taking care of plants and animals during my absence. Voucher specimens of *U. reversalis* and *U. polygonalis* are deposited at the Bernice Pauahai Bishop Museum, Honolulu, Hawaii.

LITERATURE CITED

ANON. 1935. Forest parasite biology. Report. New Zealand State Forest Service: 10. *In* Spiller, D. M. & K. A. J. Wise (1982), A catalogue (1860–1960) of New Zealand insects and their host plants. Dept. Scientific Industrial Research Bull. 231. Wellington, New Zealand. 260 pp.

ARNETT, JR., R. H. 1985. American insects. Van Nostrand Reinhold Company, New York. 850 pp.

BERNAYS, E. A. & C. B. MONTLLOR. 1989. Aposematism of *Uresiphita reversalis* larvae (Lepidoptera). J. Lepid. Soc. 43:261–273.

CLARKE, J. F. G. 1971. The Lepidoptera of Rapa Island. Smithson. Contr. Zool. 56:1–282.

———. 1986. Pyralidae and Microlepidoptera of the Marquesas Archipelago. Smithson. Contr. Zool. 416:1–485.

COMMON, I. F. B. 1990. Moths of Australia. E. J. Brill, New York. 535 pp.

CROSSWHITE, C. D. 1985. Damage to mescal bean (*Sophora secundiflora*) by a Pyralid moth (*Uresiphita reversalis*). Desert Plants 7(1):32.

FENEMORE, P. G. (ed.) 1982. Plant pests and their control. Butterworths, Wellington, New Zealand. 271 pp.

FORBES, W. T. M. 1923. Lepidoptera of New York and neighboring states. Cornell Univ. Agric. Expt. Sta. Mem. 68. 729 pp.

FROGGATT, W. W. 1907. Australian insects. William Brooks and Company Ltd. Sydney, Australia. 449 pp.

GASKIN, D. E. 1966. The butterflies and common moths of New Zealand. Whitcombe and Tombs, Limited. Christchurch, New Zealand. 219 pp.

GIBBS, G. W. 1976. The role of insects in natural terrestrial ecosystems. N. Z. Entomol. 6(2):113–121.

HANNEMAN, H. 1964. Die tierwelt Deutschlands 50. Teil. kleinschmetterlinge oder Microlepidoptera. II. Die wickler (s.l.) (Cochylidae und Carposinidae). Die Zunslerartigen (Pyraloidea). 410 pp. Jena.

HUDSON, G. V. 1928. The butterflies and moths of New Zealand. Ferguson and Osborn Ltd. Wellington. *In* Spiller, D. M. & K. A. J. Wise (1982), A catalogue (1860–1960) of New Zealand insects and their host plants. Dept. Scientific Industrial Research Bull. 231. Wellington, New Zealand. 260 pp.

KHOTKO, E. I. & R. V. MOLCHANOVA. 1974. On the morphology of the immature stages of some species of the subfamily Pyraustinae (Lepidoptera, Pyralidae). Entomol. Rev. 53(4):105–111.

KIMBALL, C. P. 1965. Lepidoptera of Florida. An annotated checklist. Division of Plant Industry. Gainesville, Florida. 363 pp.

LEEN, R. 1992. Not so novel interactions of *Uresiphita* spp, (Crambidae) and their host plants. Unpubl. Ph. D. dissertation. Univ. California, Berkeley. 124 pp.

———. 1995. Biology of *Uresiphita reversalis* (Guenée) and comparison with *U. polygonalis maorialis* (Felder) (Crambidae). J. Lepid. Soc. 49:163–170.

———. 1997. Host specificity of *Uresiphita reversalis* (Guenée) (Crambidae). J. Lepid. Soc. 51:149–155.

LEONARD, M. D. 1926. A list of the insects of New York with a list of the spiders and certain other allied groups. Cornell Univ. Agric. Expt. Sta. Mem. 101. 1121 pp.

MASTRO, L. 1990. A study on the natural history of *Cytisus* (Fabaceae) on Santa Catalina Island with an emphasis on biological control. Unpubl. M. Sc. Thesis. California State Univ., Long Beach. 78 pp.

MCKENZIE, H. L. 1933. Observations on the Genista caterpillar. Calif. State Dept. Agric. Monthly Bull. 22:410–412.

MEYRICK, E. 1889. Descriptions of New Zealand Micro-Lepidoptera. Trans. N. Z. Inst. 21:154–188. *In* Spiller, D. M. & K. A. J. Wise (1982), A catalogue (1860–1960) of New Zealand insects and their host plants. Dept.Scientific Industrial Research Bull. 231. Wellington, New Zealand. 260 pp.

MILLER, D. 1935. Garden pests in New Zealand. A popular manual for practical gardeners, farmers and schools. Cawthron Institute Monographs 1. 84 pp.

MONTLLOR, C. B., E. A. BERNAYS & R. V. BARBEHENN. 1990. Importance of quinolizidine alkaloids in the relationship between larvae of *Uresiphita reversalis* (Lepidoptera: Pyralidae) and a host plant, *Genista monspessulana*. J. Chem. Ecol. 16:1853–1865.

MULVAY, R. T. 1978. Biology of the Kowhai Moth *Uresiphita polygonalis maorialis*. Unpubl. M. Sc. Thesis. Univ. Auckland, New Zealand. 30 pp.

MUNROE, E. 1976. *In* Dominick, R. B., et al., The moths of America north of Mexico, Fasc. 13. 2A, Pyraloidea (in part). E. W. Classey Ltd., England. 150 pp.

PALM, E. 1986. Nordeuropas Pyralider: med saerligt henblik pa den danske fauna (Lepidoptera: Pyralidae). Kobenhaven: Fauna Boger. 287 pp.

PEREZ DE PAZ, P. L., M. J. DEL ARCO, J. R. ACEBES & W. WILDPRET. 1986. Leguminosas forrajeras de Canarias. Publicaciones Cientificas del Excmo. Caildo Insular de Tenerife. Museo Insula de Ciencias Naturales. Num 2. 157 pp.

PINHEY, E. C. G. 1975. Moths of Southern Africa. Tafelberg Publishers Ltd. Cape Town, South Africa. 273 pp.

POWELL, J. 1992. Recent colonization of the San Francisco Bay Area, California by eight exotic moths (Lepidoptera: Tineoidea, Gelechioidea, Tortricoidea, Pyraloidea). Pan-Pac. Entomol. 68:105–121.

PURDIE, A. 1882. Entomological notes. N. Z. J. Sci. 1:94–95. *In* Spiller, D. M. & K. A. J. Wise (1982), A catalogue (1860–1960) of New Zealand insects and their host plants. Dept. Scientific Industrial Research Bull. 231. Wellington, New Zealand. 260 pp.

SCHWARTING, A. E. 1973. The quinolizidine alkaloids. Nobel 25 chemistry in botanical classification, pp. 205–210.

SCOTT, R. R. (ED.) 1984. New Zealand pest and beneficial insects. Lincoln Univ. College Agriculture. Canterbury, New Zealand. 373 pp.

SMITH, W. N. 1890. *Mecyna maorialis* Tr. in New Zealand. Entomol. Mon. Magazine 26:218–219. *In* Spiller, D. M. & K. A. J. Wise. (1982), A catalogue (1860–1960) of New Zealand insects and their host plants. Dept. Scientific Industrial Research Bull. 231. Wellington, New Zealand. 260 pp.

SWEZEY, O. H. 1954. Forest entomology in Hawaii. Bernice P. Bishop Mus. Special Publ. 44. 266 pp.

WHITE, E. P. 1954. Alkaloids of the Leguminosae. Part XXIII: the occurrence of N-methyl-beta-phenylethylamine in *Acacia prominens* A. Cunn. N. Z. J. Sci. Tech. 35:451–455.

———. 1957. Alkaloids of the Leguminosae. Part XXVI: examination of further legumes, mainly *Lupinus* and *Acacia* species for alkaloids. N. Z. J. Sci. Tech. 38:718–725.

WINK, M. 1992. The role of quinolizidine alkaloids in plant insect interactions, pp. 131–166. *In* Bernays, E. A. (Ed.), Insect-plant interactions. Volume IV. CRC Press. Boca Raton, Florida.

ZIMMERMAN, E. C. 1958. Insects of Hawaii. Univ. Hawaii Press, Honolulu. 456 pp.

Received for publication 29 December 1993; revised and accepted 17 April 1996.